

LOWER PALAEOZOIC CORALS FROM NEW SOUTH WALES

by D. L. STRUSZ

ABSTRACT. A collection of corals from an area of some 30 square miles near Wellington, in central-western New South Wales, is described. These comprise twelve rugose and sixteen tabulate species from stratigraphic horizons, ranging from probable Upper Ordovician to Lower or Middle Devonian. Species of the rugose genera *Phaulactis*, *Entelophyllum*, *Disphyllum*, *Palaeophyllum*, *Tryplasma*, *Nipponophyllum*, and *Coronoruga* gen. nov., and the tabulate genera *Heliolites*, *Propora*, *Favosites*, *Multisolenia*, *Striatopora*, *Acanthohalysites*, *Halysites*, *Schedohalysites*, *Falsicatenuipora*, *Quepora*, and *Syringopora* are described, and three new species are erected.

THE corals described in this paper were collected from a number of localities and horizons in the parishes of Mumbil and Narragal, on the Bell River some 8 miles south of Wellington (see locality map, text-fig. 1). The area is on the central-western slopes of New South Wales, about 240 miles by road from Sydney.

Joplin (1952) has summarized previous stratigraphic work on the Molong-Wellington region. From the area dealt with in this paper, Etheridge (1907) recorded *Pseudamplexus princeps* (Eth.) from ' . . . Por. 29, Parish Narragal, Molong District, County Gordon; east side of Por. 5, Parish Mumbil, County Wellington . . . '. This species has been regarded as a Lower and Middle Devonian indicator, but both the above localities are now known to be of Middle Silurian age. However, the reliability of Etheridge's reference is uncertain, as the actual specimens are not listed. Hill (1942) lists *?Aulacophyllum* sp. from Portion 105, Narragal Parish. This also is in Middle Silurian limestone. She also lists three other localities of Silurian age, all to the north of Wellington. This is the only palaeontological work to date.

In 1952 very few Ordovician graptolite localities were known in central-western New South Wales. Since then, however, many have been discovered, often in tuffaceous rocks. Sherrard (1954) contains a complete list as then known, and many more have since been found. It appeared from this that the andesitic tuffs and lavas placed by Joplin (1952) in the Middle Silurian, as the Nanima Formation, were all of Ordovician age. Work by the author during 1958, and by Mr. K. J. Kemezys during 1959, has shown that some of these rocks belong to a separate formation, within which the Siluro-Devonian boundary must lie.

The stratigraphy and structure of the area under consideration are shown in text-fig. 1. The Upper Ordovician-Lower Silurian rocks consist of heavily albitized andesitic and basaltic lavas and pyroclasts, detritus from these, together with some limestone lenses (particularly in the Oakdale anticline). The Ordovician graptolites (locality G, text-fig. 1) found and identified are *Climacograptus scharenbergi* Lapworth, *Orthograptus truncatus* var. *intermedius* Elles and Wood, and *Dicellograptus* sp. cf. *elegans* var. *rigens* Lapworth. These correspond to the zone of *Dicranograptus clingani* in the British succession (Elles and Wood 1913). Two unidentifiable diplograptids were also found near locality 247.

No usable graptolites have been found in association with the limestones in this area. Dr. G. H. Packham (in press) has found a similar sequence of lavas and sediments with

thin limestone bands, some distance to the south, 5 miles north-west of Euchareena (locality 'Molong b' in Sherrard 1954, p. 83). The graptolite fauna here contains *Climacograptus bicornis* (Hall), ?*C. scharenbergi* Lapworth, *Orthograptus* sp. cf. *apiculatus* (Elles & Wood), and ?*Lasiograptus harknessi* (Nicholson). These Sherrard places in the zone of *Climacograptus peltifer*. From this it would seem probable that no deposition occurred in the Lower Silurian, the lowermost formation being wholly Ordovician in age.

The overlying massive and detrital limestone contains, in a rich fauna, *Phaulactis shearsbyi* (Süssmilch) and *Entelophyllum latum* Hill, which elsewhere occur in the Wenlockian and Ludlovian (Hill 1940). Halysitids have been found in the base of the limestone; other accurately dated New South Wales limestones with a halysitid fauna do not extend above the Llandoveryan. The age of the main limestone in the area probably, therefore, extends from the topmost Llandoveryan through most or all of the Wenlockian.

Above the limestone is a succession of shales. Near the base is an horizon of grey chert containing *Monograptus bohemicus* (Barrande); this Lower Ludlovian horizon places the top of the limestone at about the Wenlock-Ludlow boundary, and a limestone lens just above the chert (locality 260) as Ludlovian.

A few corals, and *Atrypa* sp., were found in limestone lenses in the overlying andesitic rocks, but proved to be of no stratigraphic use. Above these rocks is a series of calcarenites and shales. Their stratigraphic position and limited fossil content suggested a Lower Devonian age, but this could not be proved. However, to the west of Wellington, in a belt extending south to Molong, are limestones, calcarenites and shales—the Garra beds (Joplin 1952), which are Lower and Middle Devonian in age. During 1959 the author, working in Curra Creek, 9 miles to the west (text-fig. 1), discovered a succession of andesitic tuffs and detrital rocks (many closely resembling those in the Mumbil area) which passed conformably upwards into the Garra beds. This suggests that the calcarenites in the Mumbil area are equivalent to the Garra beds, while the volcanics straddle in time the Siluro-Devonian boundary.

The described fauna, in ascending stratigraphic horizons, is:

1. Upper Ordovician or Lower Silurian. Rugosa: *Palaeophyllum rugosum*, *Tryplasma lonsdalei*, *T. derrengullenense*?, *Nipponophyllum* sp. aff. *giganteum*. Tabulata: *Heliolites daintreei*, group 4, *Propora conferta*, *Favosites gothlandicus*, *Multisolenia tortuosa*, *Acanthohalysites australis*, *Schedohalysites orthopteroides*, *Halysites lithostrotonoides*, *H. sp.*, *Falsicatenuipora chillagoensis*, *Quepora bellensis* sp. nov., *Syringopora* sp.

2. Base of the Middle Silurian Limestone. Rugosa: *Phaulactis shearsbyi*, *Palaeophyllum* sp. nov.? Tabulata: *Heliolites daintreei*, group 4, *Propora conferta*, *Multisolenia tortuosa*, *Acanthohalysites australis*, *Syringopora* sp.

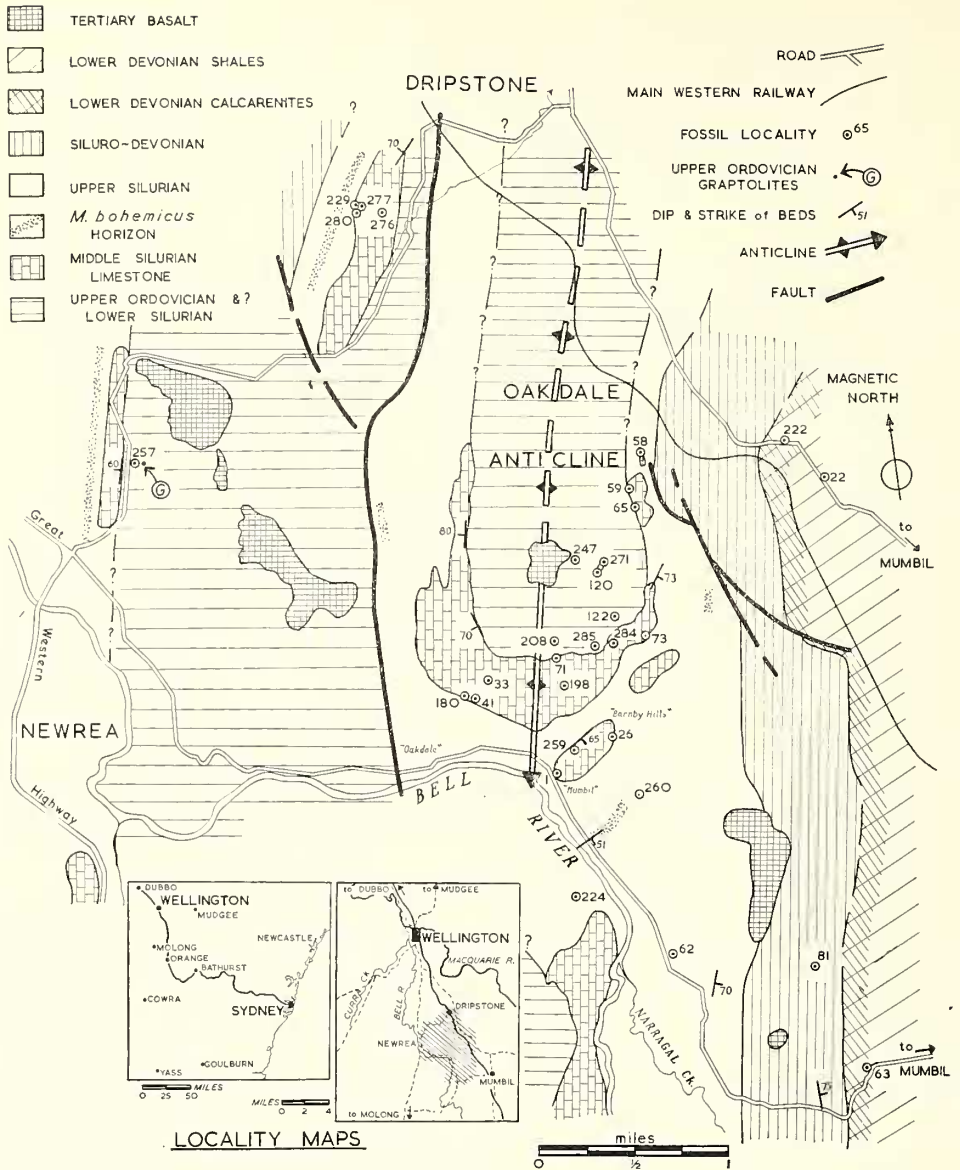
3. Middle Silurian. Rugosa: *Phaulactis shearsbyi*, *Entelophyllum latum*, *Tryplasma lonsdalei*, *T. wellingtonense*, *T. columnare*?, *Nipponophyllum multiseptatum* sp. nov., *Coronoruga dripstonense* gen. et sp. nov. Tabulata: *Heliolites daintreei*, groups 1 and 4, *Propora conferta*, *Favosites allani*, *F. gothlandicus*, *Striatopora* sp., *Syringopora* sp., sp. nov.?

4. Upper Silurian. Rugosa: *Disphyllum* sp. ?aff. *floydense*, *Tryplasma lonsdalei*.

5. Siluro-Devonian (Volcanics). Rugosa: *Tryplasma derrengullenense*?

6. Lower Devonian. Rugosa: *Tryplasma derrengullenense*?. Tabulata: *Heliolites daintreei*, group 3, *Favosites gothlandicus*?, *F. sp.*

In the following pages the term 'variety' is used only when erected previously; its meaning in each case is that of the original author. For simplicity, R. Etheridge, jun., has been referred to as 'Etheridge'.



TEXT-FIG. 1. Geological and locality maps. The inset locality maps show the position relative to Wellington, and in New South Wales. Ruled area on locality map shows the position of the area studied.

'Locality' is abbreviated to 'loc.:'; the numbers used are shown in text-fig. 1, and are the specimen numbers used during field work. Specimens with numbers prefixed by 'USGD' are housed in the Department of Geology and Geophysics, University of Sydney. The author would like to thank Professor C. E. Marshall for allowing use of his department's facilities, and Dr. G. H. Packham, Dr. P. J. Coleman, and Mr. F. G. Larminie, all of Sydney University, for much help, advice, and information, and for criticizing this paper. Dr. Dorothy Hill, of the University of Queensland, gave valuable advice regarding *Palaeophyllum* and *Coronoruga*.

SYSTEMATIC PALAEOONTOLOGY

Order RUGOSA

Suborder STREPTELASMATINA Wedekind 1927

Superfamily ZAPHRENTICAE Edwards and Haime 1850

Family HALLIIDAE Chapman 1893

Subfamily LYKOPHYLLINAE Wedekind 1927

Genus PHAULACTIS Ryder 1926

Type species Phaulactis cyathophylloides Ryder 1926.

Phaulactis shearsbyi (Süssmilch) 1914

Plate 42, figs 1, 2

- 1904 *Cyathophyllum shearsbyi* Etheridge 1904a, footnote, p. 288 (nom. nud.).
 1914 *Cyathophyllum shearsbyi* Süssmilch (ex Etheridge MS.), pl. 14B, facing p. 44. Limestone Creek, Bowning district; Upper Silurian (*Barrandella* Shales).
 1920 *Cyathophyllum shearsbyi* Süssmilch; Chapman, p. 183, pl. 18, fig. 7; pl. 19, fig. 9.
 1935 *Phaulactis shearsbyi* (Süssmilch); Hill, p. 507, fig. 18d.
 1936 *Hercophyllum shearsbyi* (Süssmilch); Jones, p. 54, pl. 5, figs. 1a-g; pl. 6, figs. 1a-g; pl. 7, figs. 1h-i, 2.
 1940 *Hercophyllum shearsbyi* (Süssmilch); Hill, p. 403, pl. 12, figs. 8, 9.
 1942a *Hercophyllum shearsbyi* (Süssmilch); Hill, p. 7, pl. 2, fig. 4.

Material. USGD 10179 (Pl. 42, fig. 1), locality 59; USGD 10185, loc. 65; USGD 10204 (Pl. 42, fig. 2), 10215, 10220, loc. 73; USGD 10281, loc. 198; USGD 11203,-04, loc. 284, Middle Silurian.

Definition. Septa attenuate in dissepimentarium, but dilated at first in tabularium, dilation decreasing from axis outwards during ontogeny, with one early reversal; major septa reach or almost reach axis, and are gently curved; tabularium wide, with gently domed tabular floors, usually of large tabellae; dissepiments small, regular, frequently geniculate. (After Hill 1940.)

Description. The specimens examined are typical of the species. USGD 10215 was the largest corallite collected, being 30 mm. in diameter. The septa are numerous—e.g. USGD 10179 has ninety-four—and thin, some bearing poorly developed zigzag carinae peripherally (USGD 10204, 10179). The major septa interfinger slightly at the axis, and are a little dilated in the tabularium, this dilation decreasing towards the axis. The minor septa extend to the edge of the tabularium, and are half to two-thirds the radius in length. The tabellae are highly irregular, generally sagging.

Remarks. This species, with *Entelophyllum latum* Hill, has so far proved an excellent indicator of the Wenlockian and Ludlovian. It is distinguished from *E. latum* by the axial interfingering and slight twisting of the septa, and the lack of a series of flatly arched tabellae at the outer margin of the tabularium.

Family ARACHNOPHYLLIDAE Dybowski 1873
 Subfamily ARACHNOPHYLLINAE Dybowski 1873
 Genus ENTELOPHYLLUM Wedekind 1927

Type species by subsequent designation Lang, Smith, and Thomas 1940: *Madreporites articulatus* Wahlenberg 1821.

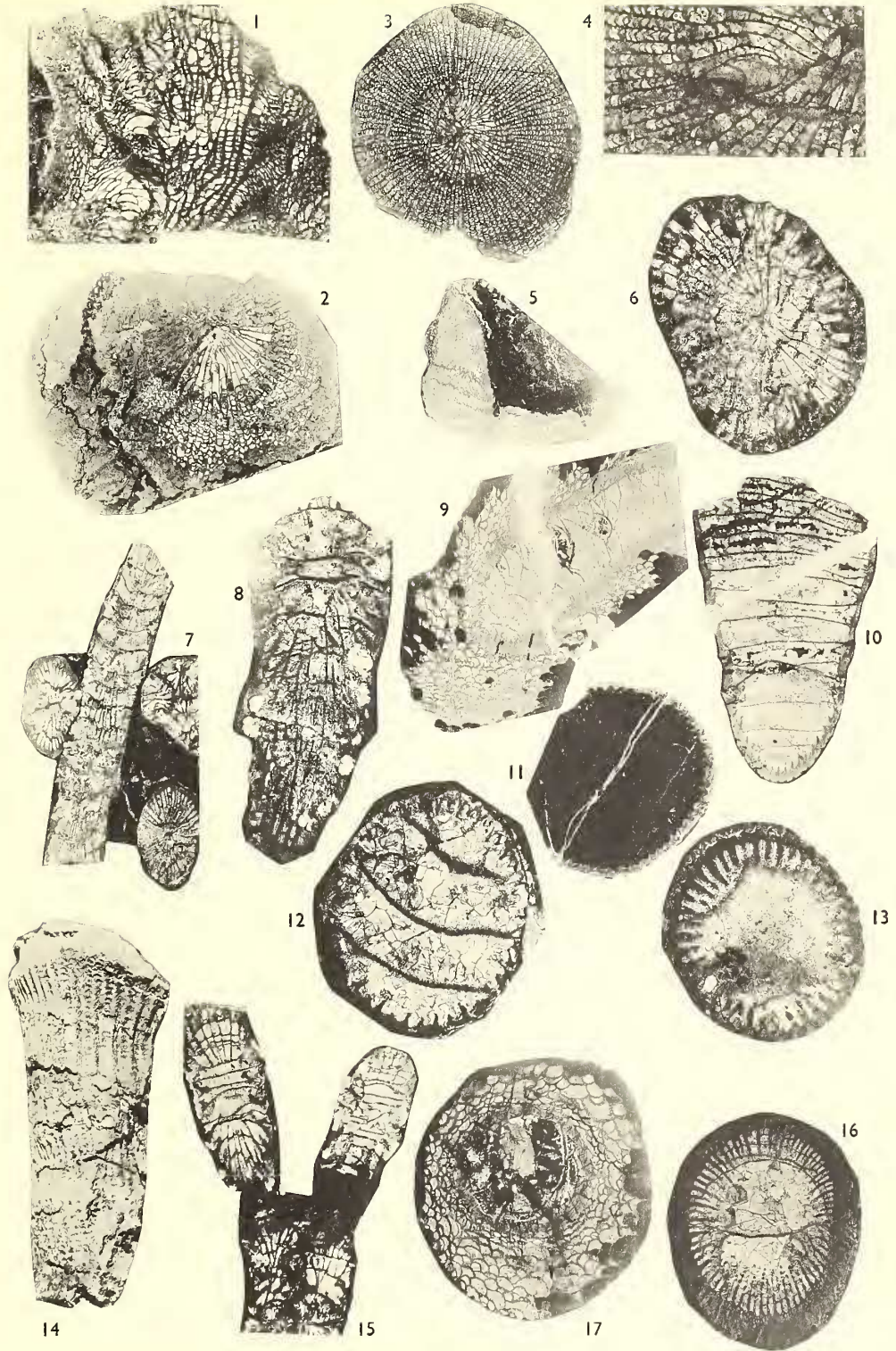
Entelophyllum latum Hill 1940

Plate 42, figs. 3-5

1940 *Entelophyllum latum* Hill, p. 413, pl. 13, figs. 8-10. Glenbower, Yass; Silurian (Middle?).1942a *Entelophyllum* sp. Hill, p. 4, pl. 2, figs. 1a, b.*Material.* USGD 10212 (Pl. 42, figs. 3-5), loc. 73. Middle Silurian.*Diagnosis.* *Entelophyllum* with numerous thin septa and with axial structure so wide as almost to fill the tabularium (Hill).*Description.* Solitary, with a diameter of 40 mm. There are 102 long septa, the major septa slightly withdrawn from the axis, and the minor septa about two-thirds as long as the major, extending to the inner edge of the wide dissepimentarium. The septa are thin, with zigzag carinae, and there appears to be a small fossula formed by slight deflection of a few major septa within the tabularium (Pl. 42, fig. 4). Dissepiments small, globose, and extremely numerous. Tabulae irregular, mostly incomplete, sagging axially, surrounded by a zone of arched tabellae. The calice is wide and deep, with very steep sides, and with a low, wide, slightly concave axial boss formed by the tabellae and tabulae.*Remarks.* This specimen differs from the holotype in possessing carinate septa and what appears to be a small fossula. Hill (1942a) has described '*Entelophyllum* sp.' from the Gordon River in Tasmania, which is distinguished from *E. latum* s.s. only in possessing carinate septa as in USGD 10212. Hill (1942a) states that '. . . *E. latum*, . . . is without

EXPLANATION OF PLATE 42

- Figs. 1, 2. *Phaulactis shearsbyi* (Süssmilch). 1, Longit. sect. of USGD 10179, showing irregular tabellae and septa. Loc. 59. $\times 1.7$. 2, Transv. sect. of USGD 10204. Note recrystallization. Loc. 73. $\times 1.4$.
- Figs. 3-5. *Entelophyllum latum* Hill. Transv. and longit. sects of USGD 10212. 3, The septa are slightly withdrawn from the axis, as opposed to *Phaulactis shearsbyi* (fig. 2), where they intertwine. Loc. 73. $\times 0.9$. 4, Detail of fig. 3, showing fossula, as indicated by curving of the septa. $\times 2.8$. 5, Showing calice. $\times 0.9$.
- Fig. 6. *Disphyllum* sp. aff. *floydense* (Belanski). Transv. sect. of USGD 11186. The blurred features, and possibly the darker patches peripherally, are due to heavy recrystallization. For longitudinal section, see text-fig. 2. Loc. 260. $\times 4.1$.
- Figs. 7, 8, 15. *Palaeophyllum rugosum* Billings. Longit. and oblique transv. sects. of USGD 10240. 7, Note budding corallite (quadripartite, peripheral), upper right. Upper Ordovician (possibly basal Silurian), loc. 122. $\times 1.2$. 8, Tabulae have down-turned edges, and sag slightly axially. Note rare small tabellae. $\times 3.7$. 15, Note occasional incomplete tabulae. $\times 1.2$.
- Figs. 9, 17. *Coronoruga dripstonense* gen. et sp. nov. 9, Longit. sect. of paratype USGD 11103. The epitheca has been removed but there remains a suggestion of the variation in diameter shown by other sections. $\times 1.2$. 17, USGD 11215, paratype, loc. 229.
- Figs. 10, 11. ?*Tryplasma columnare* Eth. Longit. and transv. sects. of USGD 11197. 10, Note septal spines on right-hand wall. Middle Silurian limestone, loc. 280. 10, $\times 1.7$; 11, $\times 1.5$.
- Figs. 12, 13. *T. lonsdalei* Eth. 12, Transv. sect. of USGD 10186. As is common, the septa appear as short lamellae. Loc. 62. $\times 3.6$. 13, Transv. sect. of USGD 10201, showing transected septal spines. Loc. 73. $\times 3.6$.
- Fig. 14. *T. derrengullenense*? Eth. Weathered specimen from flow breccia in ?Lower Devonian volcanics; USGD 10223, loc. 81. $\times 1.9$.
- Fig. 16. *T. wellingtonense* Eth. Transv. sect. of USGD 10217, showing wide stereozone, long acanthine septa. Loc. 73. $\times 2.5$.



STRUSZ, Australian Palaeozoic corals

carinae . . .', but in the original description (1940) remarks that paratypes from near the type locality at Glenbower '. . . show septa thickened and with carinae, . . .' and gives no indication that this is of taxonomic significance. Even from a purely stratigraphic viewpoint, separation into two species would be valueless, and taxonomically this would be quite unjustified. Clearly USGD 10212 and *Entelophyllum sp.*, from Tasmania, are both *E. latum*. The species is a Wenlock–Ludlow marker.

Family PHILLIPASTRAEIDAE Roemer 1883
 Subfamily PHILLIPASTRAEINAE Roemer 1883
 Genus DISPHYLLUM de Fromental 1861

Type species by subsequent designation Lang and Smith 1934: *Cyathophyllum caespitosum* Goldfuss 1826 pars.

Disphyllum sp. ? aff. *floydense* (Belanski) 1928

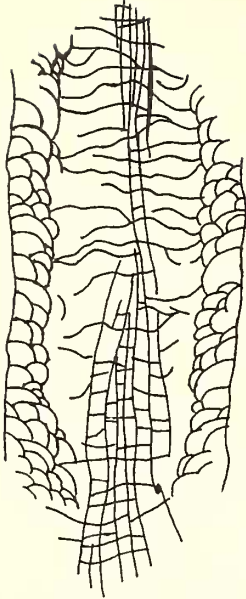
Plate 42, fig. 6; text-fig. 2

Material. USGD 11185, 11186 (Pl. 42, fig. 6; text-fig. 2), loc. 260; probably lower Ludlovian. Associated with *Favosites gothlandicus*.

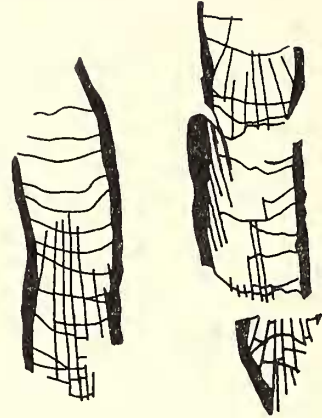
Description. Fasciculate; cylindrical corallites 5 to 8 mm. in adult diameter, the average being 6 mm. The epitheca is marked by fine concentric striae, and by very fine rugae; in many corallites there are constrictions and swellings, the latter sometimes bearing small nodes. The epitheca is quite thin. Septa slightly thickened, the dilation being greatest towards the periphery and sometimes axially also, but it is never marked; unfortunately recrystallization has blurred the septa in places. Where this has not happened, the septa can often be seen to consist of rhabdanthine trabeculae diverging from a median plane. There are about fifty septa in the adult corallite, the major septa very slightly withdrawn from the axis, and the minor septa one-third to two-thirds as long as the major; the septa may be straight, slightly curved, or somewhat irregular. The tabulae are thin, forming low domes, flat or slightly depressed axially, with a peripheral region where they slope down, and then up again slightly to meet the dissepimental wall; spaced about 10 in 5 mm. Dissepiments in two to four series, small, globose, horizontal peripherally but inclined fairly gently downwards at the inner edge of the dissepimentarium.

Remarks. Externally, allowing for the fact that the corallites are not in their growth position, these specimens resemble *D. floydense*, although the nodes are small and not very numerous. However, the American species has fewer septa (30–34 as against 50), and the arrangement of the dissepiments is a little different; also in many parts of the corallites examined the dissepiments are partly or wholly immersed in a rather dark calcite, which may be sclerenchyme forming a discontinuous peripheral stereozone, although it is more probably an effect of recrystallization. Lacking sections of *D. floydense*, an Upper Devonian species, actual affinities are difficult to determine.

Of the Australian species, the only Silurian one, *D. praecox* (Hill 1940), is half as large again, has only one series of dissepiments, and shorter major septa. *D. curtum* (Hill 1954a) has short major septa. *D. speleanum* (Hill 1950) is smaller, with fewer septa, which are dilated, and a distinctive trabecular arrangement; *D. gemmiforme* (Hill 1940)



TEXT-FIG. 2. *Disphyllum* sp. aff. *Floydense* (Belanski). Longit. sect. of USGD 11186, $\times 7.2$. Traced from photograph; recrystallization is too extensive for reproduction. Interpolation has been kept to a minimum in this and other text-figures.



TEXT-FIG. 3. *Palaeophyllum rugosum* Billings. Longit. sect. of USGD 10245, $\times 3.6$, showing tabulae sagging axially, sometimes incomplete. Tracing of a photograph.

and *D. robustum* (Hill 1942b) both have subequal septa. All these, and several others quite unlike USGD 11186, are Devonian forms.

Suborder COLUMNARIINA Rominger 1876
Family STAURIIDAE Edwards and Haime 1850
Genus PALAEOPHYLLUM Billings 1858

Type species Palaeophyllum rugosum Billings 1858.

Diagnosis. Phaceloid corallites with major septa slightly withdrawn from axis, and short minor septa; narrow peripheral stereozone; tabulae usually complete, flat or axially depressed, may have downturned edges. (See also Hill 1959.)

Remarks. The above classification and diagnosis result from a study of Bassler (1950), and original descriptions of species.

Lang, Smith, and Thomas (1940, p. 94) considered the type species to be 'a phaceloid species of the Streptelasmidae'. Hill (*in* Moore 1956) followed this interpretation, giving the diagnosis: 'Like *Streptelasma* but phaceloid.' Bassler (1950), however, working from Billings' and Lambe's descriptions and figures, considered that the genus is more closely allied to *Favistella* Dana, and so placed *Palaeophyllum* in his family Favistellidae, which is synonymous with the family Stauriidae Edwards and Haime.

Streptelasma is defined by Hill (1956) as possessing a loose axial structure, and axial lobes on the septa. However, published figures of *P. rugosum* (Bassler 1950; Hill 1956; 1959) indicate no such structures. No other species since referred to *Palaeophyllum* has an axial complex or axial lobes; all have simple septa slightly withdrawn from the axis.

Hill (1959), after studying the type species and *P. thomi* (Hall), has reached the same conclusion. She comments also (p. 5): 'This brings into prominence again the question of the generic boundaries between *Favistella*, *Palaeophyllum*, and *Streptelasma*.' It could be that *Palaeophyllum* is a subgenus of *Favistella*, differing essentially in having a phaceloid rather than a cerioid growth form.

Bassler (1950) lists several species of *Columnaria* which he considers to be *Palaeophyllum*. Those described by Soshkina (1936; 1937) certainly are *Palaeophyllum*. These are *P. vulgaris* from the Middle Devonian of the North Urals, and also (1937) from the Upper Ludlovian of the West Urals, with *P. quadrisepitata* (from the latter locality). *P. umbellifrescens* Chadwick (in Williams 1919), from the Lower Silurian of Ontario, Canada, though not figured, disagrees with *Palaeophyllum* in possessing an aulos. However, the specimens Chadwick describes as *Cyathophylloides? williamsi* are certainly *Palaeophyllum*.

Radugin (1936) is not available to me: he described *Columnaria halysitoides* and *C. fascicularis* from the Ordovician (fide Bassler) or Lower Silurian of Western Siberia. If his system of naming was logical, the latter species at least could well be *Palaeophyllum*. If his *C. halysitoides* also turns out to be a *Palaeophyllum*, it will become a junior synonym of *P. halysitoides* (Troedsson). Table 1 necessarily omits Radugin's species, and also *P. stokesi* (Edwards and Haime) which is in need of revision.

Palaeophyllum divaricans Nicholson 1875 has been regarded by later authors as a *Streptelasma*. The major septa are twisted where they meet at the axis, apparently uniting to form a loose axial structure. Nicholson thought it closest to *S. corniculatum* Hall. This species is therefore also omitted.

Palaeophyllum rugosum Billings 1858

Plate 42, figs. 7, 8, 15; text-fig. 3

1858 *Columnaria erratica* Billings. Fide Bassler 1950, p. 11.

1858 *Palaeophyllum rugosum* Billings; pl. 1, figs. 6a, b. Little Discharge, Lake St. John, Quebec, Canada. Clermont limestone, Blackriveran or lowermost Trentonian.

1901 *Palaeophyllum rugosum* Billings; Lambe, p. 101.

1950 *Palaeophyllum rugosum* Billings; Bassler, pl. 18, figs. 15, 16.

1959 *Palaeophyllum rugosum* Billings; Hill, pl. 1, figs. 6a, b.

Material. USGD 10240 (Pl. 42, figs. 7, 8, 15), 10244, 10245 (text-fig. 4), 10246, 10248-50, loc. 122; also from loc. 285. Topmost Ordovician or basal Silurian.

Diagnosis. *Palaeophyllum* of mean diameter 5 to 6 mm., with forty septa, the major slightly withdrawn from the axis, the minor short; tabulae with down-turned edges, flat or with wide axial depression.

Description. Phaceloid corallites varying in diameter between 4 and 7 mm., the average adult being 5 to 6 mm. across. There is a narrow peripheral stereozone, about $\frac{1}{3}$ mm. wide. The twenty major septa extend almost to the axis, and may interfinger axially in youth. The minor septa are short, extending at most about one-third the way to the

TABLE I

Species	Corallite diameter (mm.)	Septa			Tabulae		Range		Remarks
		No. in adult	Relative length	Shape	No. in 5 mm.	Geol.	Geog.		
<i>P. rugosum</i>	4-7 avge. 5-6	40	$\frac{3}{4}$ R-R c. $\frac{1}{4}$ R	Flat or sagging axially, with downturned edges	4-5	O _m -O _u or Sl	N. Amer. and E. Aust.	Type species	
<i>P. thomi</i>	2-4.5 avge. 3.5-4	40-44	c. $\frac{3}{4}$ R $\frac{1}{4}$ R	Highly arched with axial depression; many incomplete	10-15	O _{uu}	N. Amer.	One major septum may extend to the axis, there thickening and turning aside. Stereozone $\frac{1}{3}$ mm. wide.	
<i>P. williamisi</i>	3-6 avge. 4	40-50	$\frac{2}{3}$ - $\frac{4}{5}$ R short	As in <i>P. rugosum</i>	2-5	Sl ₁	N. Amer.	Corallites 1-2 mm. apart, with rare connecting processes. Lateral increase	
<i>P. halysitoides</i>	3-6 avge. 5	c. 40	$\frac{1}{4}$ R-R very short	Arched, mostly incomplete	10-14	O _{uu}	Greenland	Halysitoid corallum	
<i>P. vulgaris</i>	4-7 avge. 5	c. 30	c. $\frac{2}{3}$ R short	Irregular, flat, or arched	c. 6	Su-Dm	Ural Mts.	Stereozone 1 mm. wide	
<i>P. quadriseptata</i>	7-9 avge. 8	c. 36	$\frac{4}{5}$ R-R $\frac{1}{2}$ R	Irregular, complete and incomplete, highly arched	?	Su _u	Ural Mts.	Four major septa extend into the axial space, but do not meet	
<i>P. troedssoni</i>	5-8 avge. 7	c. 48	R $\frac{1}{2}$ R	As in <i>P. rugosum</i>	10-14	O _u -Sm	Greenland	Septa interfinger axially	
<i>P. vaurealense</i>	2.5-3	32	R $\frac{1}{3}$ R	Thin, depressed axially, flat or downturned peripherally	c. 10	O _{uu}	N. Amer.	Septa unite at axis	
<i>P. pasense</i>	3-4.5	30	R	Arched	7-8	O _u	N. Amer.	Halysitoid corallum	
<i>P. pasense parvum</i>	1.7-2	20	R	Arched	c. 10	O _u	N. Amer.	May be dwarfed <i>P. pasense</i> —found in shaley dolomite of one locality	

axis. Both orders are thin and straight. The tabulae are thin, complete, with very rare small tabellae, and are generally flat, often with down-turned edges, but may be broadly and gently domed or sagging; they are evenly spaced, seven to nine in 10 mm. Increase is quadripartite, peripheral, and apparently parricidal, the young corallites being cerioid shortly after formation (and so completely filling the parent calice).

Remarks. The above diagnosis is based on the figures and data published by Billings, Lambe, and Bassler. The description applies to the numerous specimens collected. Compare Hill (1959 and in press).

Palaeophyllum sp.

Material. USGD 10199, loc. 71. Middle Silurian.

Description. Corallites phaceloid, with an average diameter of 10 mm. There are fifty to sixty thin, straight, lamellar septa, the major septa reaching a little over half-way to the axis, while the minor septa are very short, being mere ridges projecting from a 0.5-mm.-wide peripheral stereozone. The tabulae are thin, and from the three transverse sections obtained appear to be complete, rather irregular, and closely spaced.

Remarks. As can be seen from the table of species above, this is larger than the species so far described; it may well be a new species, but the material is far too limited for one to be erected.

Suborder CYSTIPHYLLINA Nicholson 1889

Family TRYPLASMATIDAE Etheridge 1907

Genus TRYPLASMA Lonsdale 1845

Type species *Tryplasma aequabile* Lonsdale 1845.

Tryplasma lonsdalei Etheridge 1890

Plate 42, figs. 12, 13; text-fig. 4

1890 *Tryplasma lonsdalei* Etheridge, p. 15, pl. 1, figs. 1–6. Hatton's Corner, Yass. Silurian.

1907 *Tryplasma lonsdalei*, with vars. *scalariforme* and *minor*. Etheridge, p. 77, and plates (see Hill 1940).

1937 ? *Tryplasma dendroidea* Etheridge; Hill, p. 151.

1940 *Tryplasma lonsdalei* Etheridge; Hill, p. 406, pl. 12, figs. 13, 14.

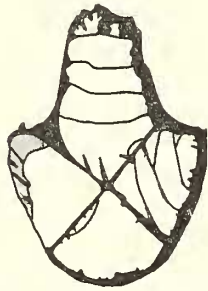
Material. USGD 10163, loc. 33; USGD 10164, loc. 41; USGD 10186 (Pl. 42, fig. 12), loc. 62; USGD 10201 (Pl. 42, fig. 13), 10210, 10213, loc. 73; USGD 10280, loc. 180; USGD 10298, loc. 224; USGD 11183 (text-fig. 5), loc. 259. Middle Silurian. USGD 11109, 11117, loc. 247; USGD 11207, loc. 285. Topmost Ordovician or Lower Silurian.

Diagnosis. Phaceloid *Tryplasma* with corallites 6 mm. in average diameter, with connecting process. (Hill 1940.)

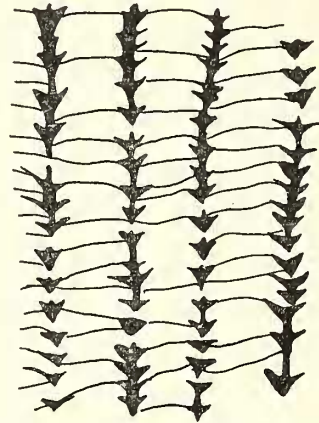
Description. Sub-phaceloid corallites 7 to 10 mm. in diameter. Hill (1940) notes that the average diameter of the corallites in a corallum may be 8 mm., while Etheridge erected his var. *scalariforme* partly on the basis of larger average diameter; unfortunately Hill does not give the limits of variation. There are forty to forty-four acanthine septa, the major extending for one-third to half the radius, while the minor septa are usually quite short, but may be two-thirds the major septa, although always the two orders are

distinct. In transverse section, the spines often do not appear, or are seen only as dots, so that the septa appear short. The spines slant upwards fairly steeply. The peripheral stereozone is quite narrow. The tabulae are flat, complete and regularly spaced some three to four in 5 mm.

Remarks. The size of the corallites, and the regular, distant spacing of the tabulae, agree with Etheridge's 'variety *scalariforme*'; the quadripartite axial increase shown by USGD 11183 (text-fig. 5) supports this. However, Hill (1940) comments that *T. lonsdalei* s.s. can also show quadripartite increase; she also indicates that the size variation could



TEXT-FIG. 4. *Tryplasma lonsdalei* Etheridge. USGD 11183. Drawing, $\times 4$, of budding corallite, showing quadripartite increase. Slightly oblique transverse natural section.



TEXT-FIG. 5. *Favosites allani* Jones. Longit. sect. of USGD 10190, $\times 10.5$. This shows clearly the 'inverted arrowhead' form of the septa. Tracing of photograph.

well destroy the value of the variety. In view of the changes in taxonomic concepts since 1907, and of Hill's comments, it is felt that Etheridge's varieties of *T. lonsdalei* should no longer be used, serving merely to illustrate more completely the range of variation of the species. The species is previously recorded from the Middle and Upper Silurian, and from two localities from the Lower and lower Middle Devonian (Bassler 1950).

Tryplasma wellingtonense Etheridge 1895

Plate 42, fig. 16

1895 *Tryplasma wellingtonense* Etheridge, p. 160; pl. 21, figs. 1-9, pl. 22, figs. 1-5. Wellington Caves. Garra beds; Coblenzian, or ? Couvinian.

1907 *Tryplasma wellingtonense* Etheridge, p. 89, and plates.

1942c *Tryplasma wellingtonense* Etheridge; Hill, p. 187; pl. 5, fig. 10.

1954b *Tryplasma wellingtonense* Etheridge; Hill, p. 112; pl. 8, figs. 16 a, b.

Material. USGD 10217, loc. 73. Middle Silurian.

Definition. Solitary, conical at first, then cylindrical, with repeated rejuvenescence sometimes causing slight change in direction of growth, attaining a diameter of 15 mm. or

more; septal furrows very faint or absent, the epitheca being marked by rejuvenescence or growth rings only. Root-like processes rare. Septa numerous, acanthine, short, set in continuous lamellar sclerenchyme, forming a stereozone 2 mm. wide; tabulae thin, complete or incomplete. (Hill 1954b.)

Description. USGD 10217 is a slightly expanding straight cylindrical corallite reaching 15 mm. diameter with slight rejuvenescence rims. The seventy-two acanthine septa are dilated peripherally to form a stereozone 1 mm. wide, the major septa extending for about half the radius, the inner portions consisting of near-horizontal spines, while the minor septa (likewise spinose) are at least three-quarters the major septa in length. The tabulae are flat, or sometimes irregular, and fairly regularly spaced three to four in 5 mm.

Remarks. This specimen has more septa than the type specimens, approaching *T. derrengullenense* and *T. columnare*. These, however, have short septa and spinose tabulae, and differ somewhat in size. Etheridge's solitary species require extensive revision. The species has previously been recorded from the Coblenzian and Couvinian of two localities only; the known range is thus extended from the Middle Silurian to the lower Middle Devonian.

Tryplasma columnare? Etheridge 1907

Plate 42, figs. 10, 11

1907 *Tryplasma columnaris* Etheridge, p. 85, and plates. Molong district; Garra beds, Lower-Middle Devonian; Quedong, Co. Wellesley; Silurian.

1940 *Tryplasma columnare* Etheridge; Hill and Jones, p. 187; pl. 3, figs. 3, 4.

Material. USGD 11197, loc. 280. Middle Silurian.

Description. Maximum diameter 16 mm. There are fifty-eight septa, equal in length at 1.0 mm., dilated to form a peripheral stereozone 0.5 mm. wide. The tabulae are complete, flat or slightly irregular, or sometimes incomplete. They do not appear to bear trabeculae.

Remarks. Differs from the specimens described by Etheridge in the narrow stereozone and the more regular tabulae lacking trabeculae. However, the corallite is sediment-filled and somewhat recrystallized, and this may have destroyed most of the trabeculae. Differs from *T. derrengullenense* in the short, subequal septa and the more regular shape, without rejuvenescence. Hill and Jones (1940) record a corallite of the same size from limestone near Wellington Caves, of probable Devonian age.

Tryplasma derrengullenense? Etheridge 1907

Plate 42, fig. 14; Plate 43, fig. 12

1907 *Tryplasma derrengullenense* Etheridge, p. 88; pl. 22, figs. 5-8. Limestone Ck., Bowning. Silurian.

1940 *Tryplasma derrengullenense* Etheridge; Hill, p. 407; pl. 12, fig. 16.

Material. ?USGD 10159, loc. 22, Lower Devonian. USGD 10223 (Pl. 42, fig. 14), loc. 81. Topmost Silurian or Lower Devonian. USGD 11173 (Pl. 43, fig. 12), loc. 257. Upper Ordovician or Lower Silurian.

Diagnosis. Solitary, trochoid or ceratoid *Tryplasma*, with irregular rejuvenescence, and a very deep calice. (Hill 1940.)

Description. The specimens are all weathered fragments of corallites, the septal spines being visible only in USGD 11173 (Pl. 43, fig. 12), and so identification has had to be made largely on the basis of size, number of septa, and depth of the grooves left by the weathering of the septa. USGD 10159 has twenty septal grooves in an arc of about 60 deg. and so had some 100 to 120 at a diameter of about 25 mm. The deeper grooves marking the major septa have been taken as indicating *T. derrengullenense*, although the size and number of the septa are greater than described by Etheridge or Hill. Rejuvenescence is not visible, the fragment being very small.

USGD 10223-c has ninety septa, the major apparently longer than the minor, at a diameter of 15 mm., while USGD 10223-b (Pl. 42, fig. 14) shows a marked rejuvenescence rim. USGD 10223-d has an epitheca marked by faint concentric growth circles and septal grooves, but this comparative smoothness could be due to wear before burial. The corallite is 18 mm. in diameter over the rejuvenescence rim, and the major septal spines (seen in an oblique polished surface) are 2 mm. long.

USGD 11173 has twenty-two septa in an arc of about 80 deg., i.e. about 100 at a diameter of some 10 mm. The major septa are thick, rather long spines arising from short septal lamellae, while the minor septal spines are short and blunt, arising directly from the corallite wall. The nature of the septa indicates *T. derrengullenense*, although the diameter is small.

Remarks. USGD 10159 occurs in the shales above the Siluro-Devonian volcanics; stratigraphical relations to the west of Wellington indicate equivalence to the Lower and Middle Devonian Garra beds. USGD 10223 comes from either a flow breccia or an agglomerate in the volcanics. USGD 11173 comes from a marl near the Ordovician graptolite locality, and so is either Upper Ordovician or Lower Silurian in age. The species is recorded only from the Silurian of the Yass-Bowning district.

Family CYSTIPHYLLIDAE Edwards and Haime 1850

Genus NIPPONOPHYLLUM Sugiyama 1940

Type species *Nipponophyllum giganteum* Sugiyama 1940

Nipponophyllum multiseptatum sp. nov.

Plate 44, fig. 12; Plate 45, fig. 9

Material. Holotype USGD 11099, loc. 224; portion 141 (330 yards N. of por. 105, 330 yards W. of Bell R.), parish of Narragal, county Gordon. Paratype USGD 10299. Middle Silurian.

Diagnosis. *Nipponophyllum* with sixty septa, the minor half as long as the major, in corallites 10 to 15 mm. in diameter, with a peripheral stereozone, and a zone of tabellae at the edge of the tabularium.

Description. Fasciculate corallum composed of corallites 10 to 15 mm. in diameter, the average being 12 mm.; corallites contiguous or but slightly separated. Thirty discontinuous septa of each order, the major septa reaching three-quarters of the distance to the axis, while the minor septa are about half as long. The major septa appear to be more continuous than the minor septa, particularly axially, while all the septa are set in

a sclerenchymal peripheral stereozone up to 1 mm. wide, which may extend on to the dissepiments. The dissepimentarium consists of one or two rows of rather large, globose, downward sloping dissepiments separated from the narrow tabularium by a circlet of irregular arched tabellae. The tabulae are usually flat, complete and incomplete, spaced about five in 5 mm. The calice is rather deep, with a flat floor and very steep sides. Increase is by lateral budding.

Remarks. As well as size, the narrow tabularium surrounded by a zone of tabellae distinguishes this species. It is much larger than *N. colligatum* (Hill), and differs from *N. giganteum* Sugiyama in the distinction of major and minor septa. Hill (1954a) has described a coral from the Yarrongobilly Caves which may be conspecific with this. Hill likens the coral to *Nipponophyllum*, but suggests that the appearance of discontinuity in the septa 'may be due to crushing on one side of the fragment'.

Horizon. A small limestone lens in shale, laterally equivalent to the Middle Silurian limestone.

Nipponophyllum sp. aff. *giganteum* Sugiyama 1940

Plate 43, figs. 3, 4; Plate 45, fig. 12

Material. USGD 10289, loc. 208. Topmost Ordovician or Lower Silurian.

Description. Phaceloid corallum of corallites 6 to 12 mm. in diameter, the average being 9 mm. The corallites are touching, or buttressed by irregular connecting processes formed as outgrowths of the dissepimentarium. The thirty to thirty-six equal, discontinuous septa consist of discrete trabeculae arising from the dissepimental surfaces, which may or may not pierce several dissepiments; the septa extend some two-thirds of the distance to the axis. The dissepimentarium consists of two to four rows of unequal, irregular but roughly globose dissepiments, sloping sharply down towards the axis. The tabulae are generally incomplete, sagging deeply, and irregularly spaced, about five or six in 5 mm.

Remarks. The specimen is very similar to *N. giganteum*, differing in the smaller number of septa—although this is very variable—and the slightly smaller average diameter.

Genus *CORONORUGA* gen. nov.

Type species *Coronoruga dripstonense* sp. nov.

Diagnosis. Large solitary corallites with a wide dissepimentarium separated from a rather narrow tabularium by an aulos in which are embedded short, discrete trabeculae.

Remarks. This genus shares its characteristic of discrete trabeculae only with *Hedströphyllum* Wedekind 1927, *Holmophyllum* Wedekind 1927 (considered by some to be the same genus; see Hill 1940, p. 397), and *Mazaphyllum* Crook 1955. Of these, the first two are simple, and the last thamnasteroid, and in all three the trabeculae occur in the dissepimentarium, piercing several dissepiments. All lack an aulos, and both of Wedekind's genera have a small tabularium unlike that of *Coronoruga*. That of *Mazaphyllum* is very similar, although smaller, and this, plus the geographical relationship, suggests that *Mazaphyllum* is the closest to *Coronoruga*.

Coronoruga dripstonense sp. nov.

Plate 42, figs. 9, 17

Material. Holotype USGD 11104, loc. 229. Boundary of portions 194 and 116, 500 yards west of Neurea-Dripstone road, Parish of Mumbil, County Gordon, Wellington. Paratypes: USGD 11103 (Pl. 42, fig. 9), 11212, 11213, 11214, 11215 (Pl. 42, fig. 17), 11216, loc. 229. USGD 11195, 11198, loc. 280. Middle Silurian.

Diagnosis. *Coronoruga* of diameter 20 to 25 mm., the aulos generally being 1 to 2 mm. thick and about 10 mm. in diameter, with numerous small dissepiments and many axial and peripheral domed tabellae.

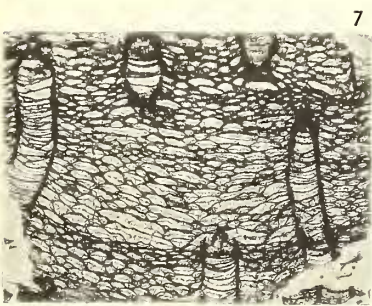
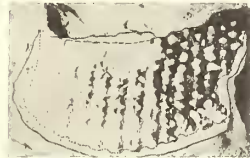
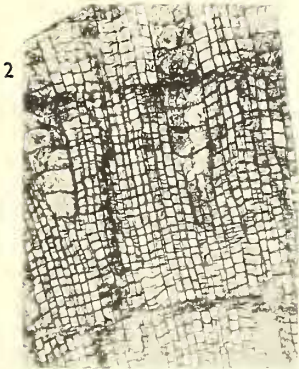
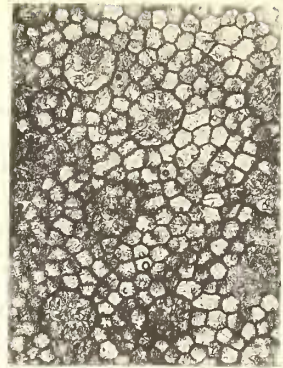
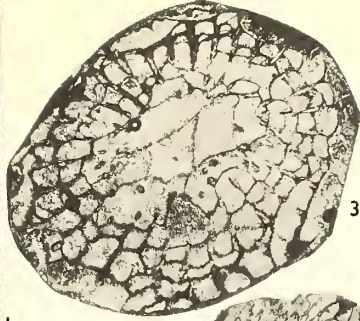
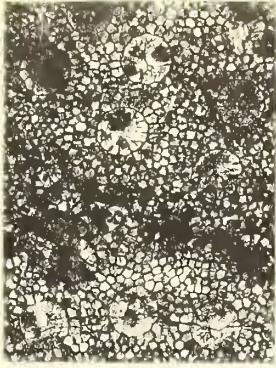
Description. Most of the corallites collected have had their epitheca worn off, but those retaining it show that it is thin, with a large number of longitudinal striae (septal grooves?) about 1 mm. apart. The maximum diameter measured is 25 mm. (USGD 11212), but it appears from a longitudinal section of USGD 11216 that the diameter is rather variable, although the diameter of the aulos remains constant. In this section the dissepimentarium varies in width from 5 to 8 mm. This kind of variation is seen in the holotype, although the epitheca is missing.

The aulos varies in thickness between 0.5 and 2.5 mm., but is usually about 1 mm. thick. It is made up of lamellar sclerenchyme, and the trabeculae pierce this, causing the lamellae to curve in towards the axis. The trabeculae arise a little in from the outer edge of the aulos, and may protrude into the tabularium for $\frac{1}{4}$ mm., although usually less; they apparently are arranged in a large number of vertical rows, in which their vertical spacing varies from $\frac{1}{4}$ to 1 mm. None of the sections is good enough (due to recrystallization) to allow counting of the septa.

The tabulae are irregular, arched or sagging, with many large, globose tabellae both axially and peripherally, always highly domed. They are thin, but most are coated with a layer of sclerenchyme up to $\frac{1}{2}$ mm. thick. The dissepiments also bear this coating of sclerenchyme, and are globose, usually small, but sometimes large and elongate; they slope down towards the axis, the inclination increasing towards the aulos, where they are often vertical and somewhat compressed. There are no trabeculae in the dissepimentarium.

EXPLANATION OF PLATE 43

- Figs. 1, 2, 5, 6. *Heliolites daintreei* Nicholson and Etheridge. 1, 2, Group 1 of Jones and Hill 1940. Transv. and longit. sects. of USGD 10165. Loc. 58. $\times 3.6$. 5, 6, Group 4, USGD 10211, loc. 73. $\times 10.2$.
- Figs. 3, 4. *Nipponophyllum* sp. aff. *giganteum* Sugiyama. 3, One corallite enlarged to show form of septa. $\times 3.4$. 4, Longit. sect. of USGD 10289. $\times 1.8$.
- Fig. 7. *Propora conferta* Edwards and Haime. Longit. and oblique sections of USGD 11174. Note discontinuities in the wall of the lowest tabularium, characteristic of the species. Loc. 257. $\times 3.6$.
- Figs. 8–10. *Favosites allani* Jones. 8, Natural longit. sect. of silicified corallum, USGD 10209, showing numerous septal spines and regular tabulae. Loc. 73. $\times 3.5$. 9, 10, Transv. and longit. sects. of USGD 10190. The corallum is heavily silicified. Note mural pores, lower middle of fig. 10. $\times 3.5$.
- Fig. 11. *Favosites* sp. Natural longit. sect. of USGD 10294, showing numerous small, blunt septal spines. Loc. 222. $\times 3.3$.
- Fig. 12. *Tryplasma derrengullenense?* Eth. Low oblique view of USGD 11173, showing short septal spines, the major proceeding from short lamellae, the minor directly from the wall of the corallum. The exposed portion of the corallum has been outlined with ink. Loc. 257. $\times 3.7$.



Order TABULATA

Family HELIOLITIDAE Lindström 1876
 Subfamily HELIOLITINAE Lindström 1876
 Genus HELIOLITES Dana 1846

Type species Astraea porosa Goldfuss 1826.

Heliolites daintreei Nicholson and Etheridge 1879

Plate 43, figs. 1, 2, 5, 6

1940 *Heliolites daintreei* Nicholson and Etheridge; Hill and Jones, p. 201; pl. 8, fig. 5.

1943 *Heliolites daintreei* Nicholson and Etheridge; Jones, p. 37; pl. 1, figs. 9, 10.

1954a *Heliolites daintreei?* Nicholson and Etheridge; Hill, p. 40; pl. 4, fig. 10.

1954b *Heliolites daintreei* Nicholson and Etheridge; Hill, p. 115; pl. 9, fig. 30.

Remarks. Jones and Hill (1940) divide the species into four ill-defined groups, of which three are represented in the described faunas.

Group 1. USGD 10165, loc. 58; Pl. 43, figs. 1, 2. Middle Silurian. Tabularia with thin walls round or somewhat crenulate, as thin as tubuli walls; diameter varies between 1.5 and 2.0 mm., the mean of twenty-five being 1.7 mm. Tabularia separated by two to six rows of tubuli, centre-centre distance varying between 2.5 and 4 mm. Tubuli polygonal, may have perforate walls. Septa thin, arising from the crenulations of the tabularial walls, with long spines, slanting steeply upwards, reaching halfway to the axis. Tabulae thin, flat, five to seven in 5 mm. Sola twelve to fifteen in 5 mm., thin, flat or sometimes oblique. Has fewer tabulae than the specimens described by Jones and Hill.

Group 3. USGD 10187, loc. 63; Lower Devonian. Thick-walled tabularia with crenulate walls, with long septal spines arising from the crenulations, and curving sharply upwards to approach the axis. Tabularia vary from 1.0 to 1.2 mm. in diameter, the mean being 1.1 mm.; they are separated by one to five rows of polygonal tubuli with walls thick, but thinner than the tabularial walls; centre-centre distance 1.4 to 2.8 mm. Tabulae thin, flat, eight to seventeen in 5 mm. (observed variation). Sola flat, spaced fourteen to twenty in 5 mm.

Group 4. USGD 10168, loc. 59; USGD 10196, loc. 65; USGD 10203, 10211 (Pl. 43, figs. 5, 6), loc. 73; Middle Silurian. USGD 11124, loc. 247. Upper Ordovician or Lower Silurian. The tabularia have walls a little thicker than the tubuli walls; they are crenulate, with long upcurved spines arising from the crenulations. The tabulae are thin, flat or concave, sometimes incomplete, and may bear spines. The tubuli are irregularly polygonal or rounded, sometimes vermiform. This is a very variable group as can be seen from the metric data:

Specimen	Tabularial diam. (mm.)			Distance (in mm.) between tabularial centres	Tabulae in 5 mm.	Sola in 5 mm.
	min.	max.	average			
USGD 10168	2.8	3.2	3.0	3.0 to 5.0	6-18	15-20
USGD 10196	1.0	1.2	1.1	1.0 to 2.5	5-8	18-20
USGD 10203	1.5	2.0	?	2.5 to 4.5	?	?
USGD 10211	0.5	0.8	0.6	1.0 to 2.0	10-15	c. 20
USGD 11124	1.5	2.0	?	2.0 to 3.5	7-10	15-20

USGD 10196 has slightly broad-based septa, but otherwise agrees with the description of Jones and Hill.

Subfamily PLASMOPORINAE Wentzel 1895
Genus PROPORA Edwards and Haime 1849

Type species Propites tubulatus Lonsdale 1839 pars.

Propora conferta Edwards and Haime 1851

Plate 43, fig. 7

1851 *Propora conferta* Edwards and Haime, p. 225. Borkholm, Russia. *Fide* Jones and Hill 1940.

1899 *Plasmopora australis* Etheridge, p. 33; pl. A, fig. 11; pl. B, figs. 5, 6.

1899 *Propora conferta* Edwards and Haime; Lindström, p. 93; pl. 8, figs. 32-39; pl. 9, figs. 1-23, 31, 32, 35. *Fide* Jones and Hill 1940.

1920 *Plasmopora australis* Etheridge; Chapman, p. 185, pl. 28, fig. 28.

1927 *Plasmopora shearsbyi* Dun, p. 262, pl. 21, figs. 5, 6.

1940 *Propora conferta* Edwards and Haime; Jones and Hill, p. 209; pl. 11, figs. 3-5.

Material. USGD 10199, loc. 71; USGD 10215, loc. 73; USGD 11180, loc. 259; Middle Silurian. USGD 10235, loc. 120; USGD 11125, loc. 247; USGD 11174, loc. 257 (Pl. 43, fig. 7); USGD 11189, loc. 271; USGD 11210, loc. 285. Upper Ordovician or Lower Silurian.

Description. Tabularia 1.0 to 1.5 mm. in diameter, separated by 0.5 to 2.5 mm. of coenenchyme. The tabularial walls are thick, often highly crenulate, with short discontinuities; the crenulations may extend into the coenenchyme as ridges for as much as $\frac{1}{2}$ mm., but are usually short, and sometimes non-existent. The tabulae are generally flat and complete, ten to twenty-five in 5 mm., but may sag slightly, and may be incomplete. The sola are globose, small, numerous; occasionally there occur rather elongate, larger sola. Coenenchymal trabeculae could not be found in any of the sections cut.

Remarks. This species is characterized by the frequent occurrence of discontinuities in the tabularial walls.

Family FAVOSITIDAE Dana 1846
Subfamily FAVOSITINAE Dana 1846
Genus FAVOSITES Lamarck 1816

Type species Favosites gothlandicus Lamarck 1816.

Favosites allani Jones 1937

Plate 43, figs. 8-10; text-fig. 5

1937 *Favosites allani* Jones, p. 90; pl. 12, figs. 4, 5. Silurian (*Barandella* shale), Yass.

1940 *Favosites allani* Jones; Hill and Jones, p. 189; pl. 5, figs. 1a, b.

Material. USGD 10190 (Pl. 43, figs. 9, 10), ex alluvium, 'Mumbil' homestead; USGD 10209 (Pl. 43, fig. 8), loc. 73. Middle Silurian.

Diagnosis. *Favosites* with small corallites, with numerous septal spines which are short, horizontal, and with a broad base, with small circular mural pores typically in one row, and with thin, horizontal, and usually complete tabulae, twelve to seventeen in 5 mm. (Hill and Jones 1940).

Description. USGD 10209 is a fragment some 3×2 cm., in which the polygonal corallites are 1.0 to 2.0 mm. in diameter, thin-walled, with numerous septal spines about 0.1 to 0.2 mm. long, sometimes in the form of small squamulae. The mural pores are not frequent, but are circular, 0.1 to 0.2 mm. in diameter, sometimes with a squamula immediately above. The tabulae are flat, usually regularly spaced seven in 5 mm., with one or two cycles of septal spines between each pair of tabulae.

USGD 10190 is a portion of a silicified massive corallum 5 cm. across and 3 cm. deep. The corallites vary in diameter from 1.0 to 2.5 mm., the mean of twenty-five being 1.4 mm.; most are 5- or 6-sided, but some have 3, 4, 7, or 8 sides, and may be rather irregular. The walls are 0.05 to 0.15 mm. thick, although recrystallization has often increased this, and obscured the detail. They are pierced by mural pores 0.1 to 0.2 mm. across, arranged in one or two rows (depending mainly on the width of the wall), and spaced vertically 0.4 to 0.6 mm. apart, one cycle between each two tabulae, and often with a septal spine or squamula directly above. Often these will be coincident in two adjacent corallites, forming an inverted arrowhead above the mural pore (text-fig. 5). The septa are numerous, short (up to 0.4 mm. long), and rather thick, with broad bases; they are horizontal, or pointing gently upwards. The tabulae are flat, thin, regularly spaced ten to fifteen in 5 mm.

Remarks. USGD 10190 differs from described specimens in the increased frequency of double-row mural pores. The specimen is from alluvial wash just north-east of the junction between the Mumbil-Neurea road, and portions 3 and 5, Parish of Mumbil, near 'Mumbil' Homestead; it is almost certainly derived from the top of the Middle Silurian limestone, where there are numerous similarly preserved fossils. USGD 10209 comes from near the top of the Middle Silurian limestone. The species is recorded from the Upper Silurian of Yass and the Lower or lower Middle Devonian Garra beds opposite Wellington Caves.

Favosites gothlandicus Lamarck 1816

Plate 44, figs. 1, 2

For early synonymy see Hill and Jones 1940, pp. 191-4.

1954a *Favosites gothlandicus* Lamarck, formae *gothlandicus* and *forbesi*; Hill, p. 42; pl. 4, figs. 13, 14.

Material. ? USGD 10160, loc. 22; Lower Devonian. USGD 10221, loc. 73; USGD 11196 (Pl. 44, figs. 1, 2), loc. 280. Middle Silurian. USGD 10251, loc. 122; Upper Ordovician or Lower Silurian.

Diagnosis. *Favosites* with very large, thin-walled prismatic corallites, few septa, complete rather distant tabulae, and two rows of large, circular mural pores.

Description. USGD 10160 is the impression of a small fragment in mudstone. The polygonal corallites are 1.5 to 2.0 mm. in diameter, with thin walls bearing a few short, thick septal spines, pierced by rare mural pores in one or two rows. The tabulae are spaced seven in 5 mm.

USGD 10221 is portion of a massive corallum in which the thin-walled prismatic corallites vary in diameter between 1.5 and 2.5 mm., the average being about 2 mm. Septal spines are short, and very rare. The mural pores are 0.2 to 0.3 mm. in diameter,

in two rows except on narrow walls, and usually *en echelon*, although sometimes parallel. The tabulae are flat, rarely concave, spaced fairly regularly four or five in 5 mm.

USGD 11196 is also massive. The corallites are 2 to 3 mm. in adult diameter, with frequent new corallites arising at the junctions. The walls are irregular in thickness, varying from 0.02 to 0.2 mm., and are slightly crenulated, the crenulations frequently bearing septal spines. These are numerous, closely spaced vertically, short, with broad bases, and inclined upwards. Mural pores in two rows, *en echelon*. There are somewhat discontinuous zones of wall thickening, often associated with tabular crowding. The tabulae are flat, or with median depressions, occasionally inosculating in the zones of crowding. Spacing varies from seven to fourteen in 5 mm.

USGD 10251 is a roughly hemispherical corallum about 8 cm. across. The corallites have slightly thickened walls, and are 1.0 to 3.0 mm. in diameter, the average being about 2 mm. The mural pores are sparse, usually in two rows, parallel, and rather small. The septal spines are short and thick. Tabulae flat, four to seven in 5 mm.

Remarks. USGD 10221 probably belongs to the forma *gothlandicus*. USGD 11196 differs from the normal in its zones of wall thickening and tabular crowding, the occasionally inosculating tabulae, and the slight wall crenulations. The species has been previously recorded from the Silurian and Lower Devonian.

Favosites sp.

Plate 43, fig. 11

Material. USGD 10294, loc. 222. Lower Devonian, calcarenites above the Siluro-Devonian lavas.

Description. A fragment of a ramose corallum with thick-walled corallites about 1 mm. in diameter. The septal spines are numerous, short, and blunt, and are not regularly arranged. There are no mural pores, and the remains of the tabulae appear to be widely spaced.

Remarks. Of the species tabulated by Hill (1940) the only one of comparable size with septa and widely spaced tabulae is the specimen figured as *F. alpinus* by le Maître.

Genus MULTISOLENIA Fritz 1937

Type species *Multisolenia tortuosa* Fritz 1937.

Multisolenia tortuosa Fritz 1937

Plate 44, fig. 3

1937 *Multisolenia tortuosa* Fritz, p. 231, text-figs. 1-6. Lockport formation, Ontario. Silurian.

1937 *Paleofavosites mirabilis* Tchernychev, pp. 86, 117, pl. 7, figs. 4a-c.

1956 *Multisolenia tortuosa* Fritz; Stearn, pp. 65-66, pl. 5, figs. 1-4.

Material. USGD 10178, loc. 59. Middle Silurian. USGD 10291 (Pl. 44, fig. 3), loc. 208. Upper Ordovician or Lower Silurian.

Diagnosis. *Multisolenia* with corallites 0.25 to 0.6 mm. in diameter, thin walls, and close, thin, slightly convex tabulae.

Description. USGD 10178 is an irregularly stratiform mass, while USGD 10291 is a radiating corallum in the form of a low inverted cone 12 cm. across and 5 cm. deep, the

apex being $\frac{3}{4}$ cm. across. In both the corallites are rounded, with thin walls. Multiplication is as indicated by Stearn (1956), as also are the solenia, which are regularly and closely spaced giving broken surfaces a distinctly beaded appearance. They are 0.25 mm. in diameter and ten in 5 mm. The tabulae are very thin, and are often obscured or destroyed by recrystallization; they are slightly arched, 0.25 to 1.0 mm. apart.

Subfamily PACHYPORINAE Gerth 1921

Genus STRIATOPORA Hall 1851

Type species Striatopora flexuosa Hall 1851.

Striatopora sp. Hill and Jones 1940

Plate 44, figs. 4, 5

1940 *Striatopora* sp. Hill and Jones, p. 200; pl. 8, figs. 3a-c. Crystal Springs, Molong. Garra beds, lower Devonian.

1954a ?*Striatopora* sp. Hill, p. 44; pl. 4, figs. 19a-b. Silurian.

1954b ?*Striatopora* sp. Hill, p. 115; pl. 9, figs. 28a-b. Lower to Middle Devonian.

Material. USGD 10152, loc. 1; USGD 10162 (Pl. 44, figs. 4, 5), loc. 26; USGD 10164, loc. 41; USGD 11190, loc. 276. Middle Silurian.

Description. Ramose coralla 6 to 25 mm. in diameter, the average being 10 to 15 mm. Corallites irregularly polygonal; diameter 0.5 to 1.5 mm. axially, where the walls are thin, pierced by mural pores 0.2 to 0.3 mm. across, apparently arranged in one row. This axial zone, where the corallites are nearly parallel, is one-third to two-thirds the corallum diameter, and towards its edge the corallites start to curve outwards, finally turning abruptly horizontal in a peripheral zone where the walls become dilated, and the tabulae at first become crowded, and are then replaced by a plug of sclerenchyme, sometimes interrupted by a couple of tabulae. The dilated walls are pierced by two rows of mural pores, about $\frac{1}{2}$ mm. apart; the corallites increase in diameter to 2.0 mm. This zone is usually 1 or 2 mm. thick. Axially the tabulae are flat and distant, six to ten in 5 mm. In the zone of crowding they may be four in 1 mm. Septal spines are sparse and short, often obscured by recrystallization.

Family HALYSITIDAE Edwards and Haime 1850

Subfamily HALYSITINAE Edwards and Haime 1850

Genus ACANTHOHALYSITES Hamada 1957

Type species Halysites australis Etheridge 1898.

Diagnosis. Halysitinae with septal spines in macrocorallites, with both mesocorallites and microcorallites, and most palisades with more than one macrocorallite.

Acanthohalysites australis (Etheridge) 1898

Plate 44, figs. 6, 7

1898 *Halysites australis* Etheridge, p. 78; pl. 17, figs. 1-8, Bell R., Wellington. Silurian.

1904 *Halysites australis* Etheridge, p. 29; pl. 6, fig. 4, pl. 7, fig. 6, pl. 9, figs. 1, 2.

1957 *Acanthohalysites australis* (Etheridge); Hamada, p. 404.

Material. USGD 10183 (Pl. 44, figs. 6, 7), loc. 59. Middle Silurian. USGD 11211, loc. 285. Topmost Ordovician or Lower Silurian.

Diagnosis. *Acanthohalysites* with loose, spreading corallum; fenestrules large, variable, with smooth sides; palisades of two to twelve corallites, which are oval, rather small, with twelve long septa and close, complete, irregular tabulae; microcorallites narrow, oblong, with distant tabulae; walls thick.

Description. The fenestrules are irregular in shape, at times labyrinthine. The corallites have thick walls, and are 0.75 to 1.0 mm. long by 0.5 mm. wide; the septal spines reach over half-way to the axis, and are arranged in vertical rows, five on each wall and one at each end of the corallite. The tabulae are flat, fifteen to twenty in 5 mm. The microcorallites are not always present, but where developed are slit-like in transverse section, causing no waisting of the palisades; their tabulae are distant.

Genus HALYSITES Fischer von Waldheim 1813

Type species *Tubipora catenularia* Linnaeus 1767.

Halysites lithostrotonoides Etheridge 1904

Plate 44, figs. 8, 9

1904 *Halysites lithostrotonoides* Etheridge, p. 23; pl. 1, fig. 1, pl. 4, figs. 1, 2, pl. 9, fig. 4. Spring Ck., Molong. Lower Silurian.

1920 *Halysites lithostrotonoides* Etheridge; Chapman, p. 187.

1957 *Halysites lithostrotonoides* Etheridge; Hamada, p. 402.

Material. USGD 10227, loc. 120. Topmost Ordovician or basal Silurian.

Diagnosis. *Halysites* with regular, pavement-like fenestrules, and smooth-walled palisades of one to five oblong corallites, flat-ended, 0.75 to 1.0 mm. long and $\frac{1}{3}$ mm. wide, separated by thin rectangular microcorallites. Tabulae ten in 5 mm., and twenty in 5 mm. in microcorallites.

Description. The corallites are often somewhat larger than in Etheridge's specimens, reaching 1.25 mm. in length, although the average is about 1 mm., but the flat-ended

EXPLANATION OF PLATE 44

Figs. 1, 2. *Favosites gothlandicus* Lamarck. Transv. and longit. sects. of USGD 11196. Loc. 280. $\times 3.5$.

Fig. 3. *Multisolenia tortuosa* Fritz. Transv. sect. of USGD 10291. Upper half of fig. retouched to show meandroid tabularia. Loc. 208. $\times 10.9$.

Figs. 4, 5. *Striatopora* sp. Hill and Jones. Transv. and longit. sects. of USGD 10162. 4, Negative print showing mural pores in peripheral zone. Loc. 26. 4, $\times 2.7$; 5, $\times 1.4$.

Fig. 6. *Acanthohalysites australis* (Eth.). 6, Transv. sect. of USGD 10183. Loc. 59. $\times 1.8$. 7, Enlargement of portion of fig. 6, showing septa. $\times 10.5$.

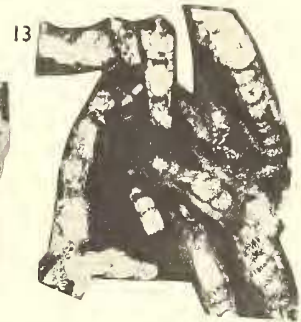
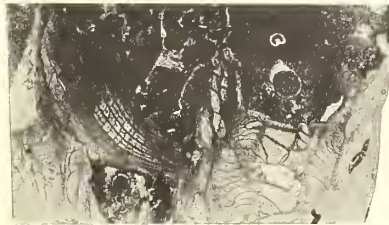
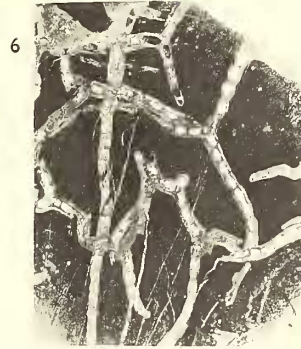
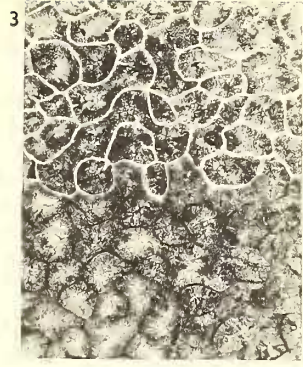
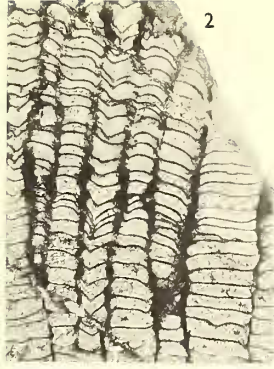
Figs. 8, 9. *Halysites lithostrotonoides* Eth. 8, Longit. and oblique transv. sects. of USGD 10227. Loc. 120. $\times 1.8$. 9, Enlargement of portion of fig. 8, longit. sect. $\times 5.1$.

Fig. 10. *Schedohalysites orthopteroides* (Eth.). Longit. sect. of USGD 11188. Loc. 271. $\times 3.4$.

Fig. 11. *Halysites* sp. Oblique transv. sect. of USGD 11115. Loc. 247. $\times 3.5$.

Fig. 12. *Nipponophyllum multiseptatum* sp. nov. Longit. sect. of holotype, USGD 11099. Note lateral bud, with relatively continuous major septa and discontinuous minor septa. Also shows form of calice. Loc. 224. $\times 1.9$.

Fig. 13. *Falsicatenipora chillagoensis* (Eth.). Transv. and oblique longit. sects. of USGD 6923. Septa can be distinguished in the transv. sects. of corallites, lower left, arranged as in *A. australis* (fig. 7). $\times 6.5$.



oblong shape is distinctive, particularly in hand specimen. There is slight corrugation of the palisades, accentuated in oblique sections. The fairly regular pavement-like fenestrules are also distinctive. The tabulae are regular, slightly concave, fifteen in 5 mm., in the corallites, and flat, twenty to twenty-five in 5 mm., in the microcorallites, which are about $\frac{1}{4}$ mm. long. The corallite walls are slightly thickened.

Halysites sp.

Plate 44, fig. 11

Material. USGD 11115, loc. 247. Topmost Ordovician or Lower Silurian.

Description. A small portion of an irregularly radiating corallum, in which the fenestrules, distally, are polygonal or somewhat irregular. There are two to six corallites to a palisade; they are 1.25 to 1.5 mm. long and 0.75 to 1.0 mm. wide, oval, aseptate, with flat tabulae spaced fifteen in 5 mm. The microcorallites are rectangular, 0.5 mm. wide and about $\frac{1}{4}$ mm. long, causing some waisting of the palisades. The corallite walls are thick.

Remarks. Differs from *A. pycnoblatooides* in absence of septa and somewhat narrower corallites. *H. süssmilchi* has labyrinthine fenestrules and more widely spaced tabulae.

Subfamily SCHEDOHALYSITINAE Hamada 1957

Genus SCHEDOHALYSITES Hamada 1957

Type species *Halysites orthopteroides* Etheridge 1904.

Diagnosis. Halysitidae in which microcorallites and mesocorallites are not present in all parts of the corallum.

Schedohalysites orthopteroides (Etheridge) 1904

Plate 44, fig. 10

1904 *Halysites orthopteroides* Etheridge, p. 25; pl. 3, figs. 1, 2, pl. 7, figs. 4, 5. Wellington district. Silurian.

1920 *Halysites orthopteroides* Etheridge; Chapman, p. 188; pl. 25, figs. 22, 23, pl. 26, fig. 24.

1957 *Schedohalysites orthopteroides* (Etheridge); Hamada, p. 401.

Material. USGD 11188, loc. 271. Topmost Ordovician or Lower Silurian.

Diagnosis. Halysitid with irregular fenestrules, palisades corrugate, of two to nine oval corallites 1–1 $\frac{1}{4}$ mm. by $\frac{3}{4}$ –1 mm.; aseptate, with irregular tabulae ten in 5 mm.; microcorallites mere slits or absent, about twenty tabulae in 5 mm.

Description. Fragments only have been examined. The corallites are 1.0 to 1.5 mm. long and 0.75 to 1.0 mm. wide, oval, with fairly thin walls. There are no septa, and the thin, flat tabulae are spaced twelve to fifteen in 5 mm. The palisades are waisted at the microcorallites.

Genus FALCICATENIPORA Hamada 1958

Type species *Halysites japonicus* Sugiyama 1940.

Diagnosis. Schedohalysitinae with mesocorallites but without microcorallites.